Freescale Semiconductor, Inc.

M68EM05E6/D
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M68EM05E6
EMULATOR MODULE
USER'S MANUAL

Second Edition

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CHAPTER 1
INTRODUCTION

This user's manual explains connection, configuration, and operation information specific to the HC05E6EM Emulator Module (E6EM). The E6EM makes possible emulation and debugging of target systems based on these microcontroller units (MCUs):

MC68HC705E6 MC68HC05E6

The E6EM can be part of two development systems. This chapter describes those systems and explains the layout of the E6EM.

The factory installs an MC68HC705E6 resident MCU in the E6EM.

1.1 DEVELOPMENT SYSTEMS

Your E6EM can be part of two Motorola development tools: the HC05 Motorola Modular Development System (MMDS05) or the M68HC05EVS Evaluation System (HC05EVS).

1.1.1 Motorola Modular Development System (MMDS05)

The MMDS05 is an emulator system that provides a bus state analyzer and real-time memory windows. The unit's integrated design environment includes an editor, an assembler, user interface, and source-level debug. A complete MMDS05 consists of:

- **a station module** — the metal MMDS05 enclosure, containing the control board and the internal power supply. Most system cables connect to the MMDS05 station module. (The cable to an optional target system, however, runs through an aperture in the station module enclosure to connect directly to the emulator module.)
- **an emulator module (EM)** — such as the E6EM: a printed circuit board that enables system functionality for a specific set of MCUs. The EM fits into the station module through a sliding panel in the enclosure top. The EM has a connector for the target cable.
- **two logic clip cable assemblies** — twisted-pair cables that connect the station module to your target system, a test fixture, a clock, or any other circuitry useful for evaluation or analysis. One end of each cable assembly has a molded connector, which fits into station-module pod A or pod B. Leads at the other end of each cable terminate in female probe tips. Ball clips come with the cable assemblies.

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- **a 9-lead RS-232 serial cable** — the cable that connects the station module to the host computer RS-232 port.
- **a 9- to 25-pin adapter** — a molded assembly that lets you connect the 9-lead cable to a 25-pin serial port.
- **system software** — software, on 3-1/2 inch diskettes.
- **MMDS05 documentation** — an MMDS05 operations manual (MMDS05OM/D) and the appropriate EM user's manual.

As mentioned, your E6EM gives the MMDS05 the ability to emulate the MC68HC(7)05E6 MCU. By substituting a different EM, you can enable your MMDS05 to emulate an MCU of a different series. (Your Motorola representative can explain all the EMs available.)

Chapter 2 explains how to configure and use your E6EM as part of an MMDS05 system. For information about MMDS05 software or the station module, see the MMDS05 operations manual. For layout and configuration information pertaining to a different EM, see the corresponding EM user's manual.

1.1.2 M68HC05EVS Evaluation System (HC05EVS)

An HC05EVS is an economical, two-board tool for designing, debugging, and evaluating target systems based on an MC68HC05 MCU. A complete HC05EVS consists of:

- **a platform board (PFB)** — the bottom board, which supports the emulator module. The platform board has connectors for power and for the terminal or host computer.
- **an emulator module (EM)** — such as the F4EM: a printed circuit board that enables system functionality for a specific set of MCUs. The EM fits onto the PFB. The EM has connectors for a target cable and for a cable to a logic analyzer.
- **an RS-232 serial cable** — the cable that connects the PFB to the host computer RS-232 port.
- **system software** — software, on 3-1/2 inch diskettes.
- **HC05EVS documentation** — an HC05EVS operations manual (HC05EVSOM/D) and the appropriate EM user's manual.

As mentioned, your HC05E6 EVS emulates the MC68HC705E6 and the MC68HC05E6 MCUs. By substituting a different EM, you can enable your HC05EVS to emulate an MCU of a different series. (Your Motorola representative can explain all the EMs available.)

Chapter 3 explains how to configure and use your E6EM as part of an HC05EVS system. For information about HC05EVS software or the platform board, see the HC05EVS operations manual. For layout and configuration information pertaining to a different EM, see the corresponding EM user's manual.

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1.2 EM LAYOUT

Figure 1-1 shows the layout of the E6EM. J1 and J2 allow the clock source to be selected. Jumper header J3 lets you select clock Stretching if required. J4 controls the path of a target reset.

Connector P1 is for a logic analyzer. (Connector P1 has more significance for an EVS system, as an MMDS05 system includes a bus analyzer.). Expansion header connectors P2 and P3 connect together the EM and the control board (for an MMDS05) or the EM and the platform board (for an EVS). Finally, Connectors P4 and P5 allow for connection of a target cable which is available separately. If you install the E6EM board in the MMDS05, the target cable passes through a slit in the MMDS05 enclosure.

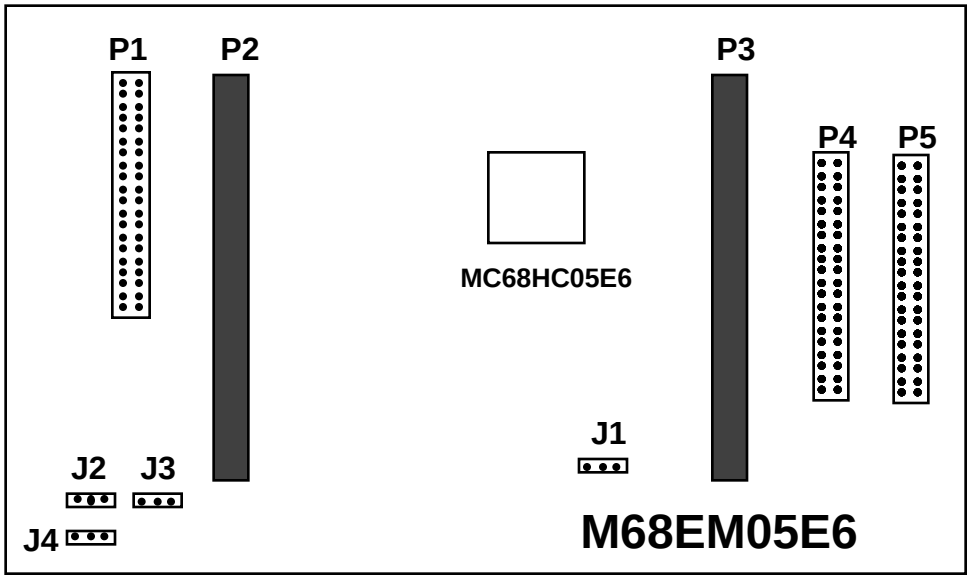

Figure 1-1. HC05E6 Emulator Module

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1.3 CONNECTORS P4 AND P5 PIN ASSIGNMENTS

Figure 1-2 shows the pin assignments for connectors P4 and P5. For signal descriptions, consult the technical data book for the specific MCU.

P4

GND	1	2	PA7	
PD2	3	4	GND	
PA6	5	6	PD3	
GND	7	8	PA5	
PD4	9	10	GND	
PA4	11	12	PD5	
GND	13	14	PA3	
PD6	15	16	GND	
PA2	17	18	PA1	
GND	19	20	PD7	
PA0	21	22	GND	
EVDD	23	24	GND	
GND	25	26	IRQ*	
GND	27	28	RESET*	
GND	29	30	GND	
OSC1	31	32	NC	
PB7	33	34	GND	
GND	35	36	LVI*	
GND	37	38	GND	
GND	39	40	GND	

P5

PB6	1	2	GND	
GND	3	4	PG0	
GND	5	6	PG1	
GND	7	8	PG2	
GND	9	10	PG3	
GND	11	12	VREFH	
GND	13	14	GND	
PB5	15	16	PB4	
GND	17	18	PB5	
PB2	19	20	GND	
PB1	21	22	PB0	
GND	23	24	PC0	
PC1	25	26	GND	
GND	27	28	PC2	
PC3	29	30	GND	
PC4	31	32	GND	
PD0	33	34	PC5	
GND	35	36	PC6	
PD1	37	38	GND	
PC7	39	40	GND	

Figure 1-2. Target Connector

As connector P1 has more importance to an HC05EVS than to an MMDS05, pin assignments for connector P1 are in Chapter 3.

To configure your E6EM for use as part of an MMDS05, follow the instructions of Chapter 2. To configure your E6EM for use as part of an HC05EVS, follow the instructions of Chapter 3.

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CHAPTER 2

MMDS05 CONFIGURATION AND OPERATION

This chapter explains how to configure and use your E6EM as part of an MMDS05. For other parts of system installation or configuration, see the MMDS05 operations manual (MMDS05OM/D). (If you intend to use your E6EM as part of an HC05EVS system, go to Chapter 3 for corresponding information.)

Paragraph 2.1 explains how to set E6EM jumper headers. Paragraph 2.2 explains considerations pertaining to the MCU you emulate. Paragraph 2.3 explains remaining system installation.

Note that you can configure a E6EM already fitted in the MMDS05 station module enclosure. To do so, switch off station-module power, remove the top panel, then follow the guidance of this chapter.

CAUTION

Be sure to switch off power if you reconfigure an installed EM. Reconfiguring EM jumper headers with power left on can damage MMDS05 circuits.

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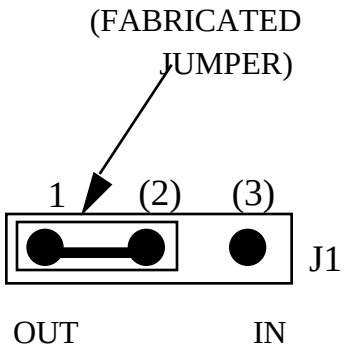
2.1 SETTING E6EM JUMPER HEADERS

Your E6EM has four jumper headers, J1 to J4. This section explains how to configure these headers.

2.1.1 Reset Select Header (J1)

Jumper header J1 controls the path of a target reset. The diagram below shows the factory configuration: the fabricated jumper between pins 1 and 2 enables your software to control resets. This is the **only** correct J1 configuration for a E6EM that is part of an MMDS05.



NOTE

Using the E6EM with the fabricated jumper installed between pins 2 and 3 will interfere with correct operation of the RESETIN and RESETOUT commands. The J1 pins 2-and-3 configuration is **not** correct for a E6EM that is part of an MMDS05 system.

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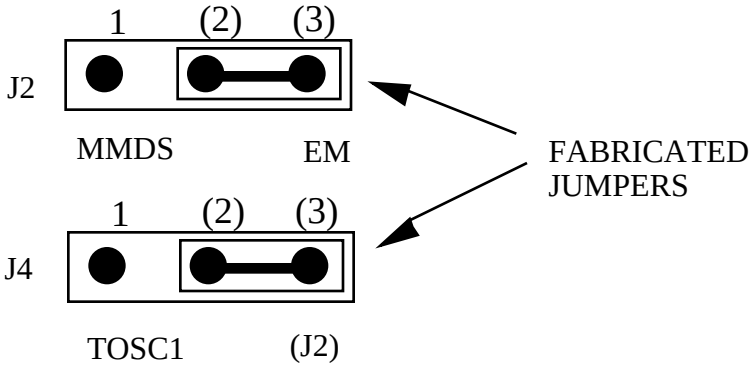
2.1.2 Clock Source Select Headers (J2, J4)

Jumper headers J2 and J4 determines the source of the clock signal. The diagram below shows the factory configuration of these jumpers: the fabricated jumper between pins 2 and 3 selects the E6EM canned oscillator clock source.

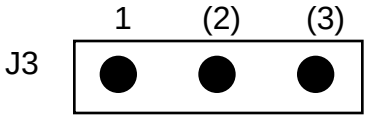


Alternatively, you may use a clock source originating from the MMDS05 control board. To do so, reposition the J2 jumper between pins 1 and 2. The MMDS OSC command can then be used to select clock frequency.

Jumper J4 can be used to select between an internal generated clock or a external clock generated by the target system. If the target clock is selected by placing the jumper on J4 between pins 1 and 2, the position of J2 is not important.

2.1.3 Clock Stretch Select Header(J3)

Jumper header J3 determines the source of clock stretching (if required). By default board is shipped from the factory with no jumper installed. ie with the clock stretch function disabled. To enable clock stretch add jumper between pins 1 and 2 for DACIA cycle stretching (affects locations $3FE0 - $3FE3) or between pin 2 and 3 for monitor map cycle stretching.



NOTE

No fabricated jumper should be installed on this header when the board is used as part of an MMDS05 system.

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2.2 THE EMULATED MCU

Your MMDS05 system uses a specific personality file for the MCU type being emulated. For example, to emulate an MC68HC05E6 or MC68HC705E6 MCU, the system uses personality file 00220Vxx.MEM this file contains device specific information such as memory map, required by the MMDS05 for correct operation.

Table 2-1 lists all the personality files that pertain to the E6EM. Note that personality file names follow the pattern **00ZZZVxx.MEM**, where **ZZZ** is the EM identifier or MCU name, and **xx** is the version of the file.

Table 2-1. MCUs and Personality Files

EMULATED MCU	PERSONALITY FILE	RESIDENT MCU	COMMENTS
MC68HC705E6	00224Vxx.MEM	MC68HC705E6	See paragraph 2.2.1.
MC68HC05E6	00ME6Vxx.MEM	MC68HC705E6	See paragraph 2.2.2.

MMDS05 software loads the default personality file for the EM board installed on powerup. To manually load a different personality file, use the LOADMEM command. (For more information about the LOADMEM command, see the explanation in the MMDS05 operations manual.)

Alternatively, you can insert the line LOADMEM 00ZZZVxx.MEM in the STARTUP.05 script file. This way, the system automatically loads the specified personality file as part of system startup. (For more information about the STARTUP.05 script file, see the SCRIPT command explanation in the MMDS05 operations manual.)

Note:- For correct operation you must install the personality file in the same directory as the MMDS05 software, place only the latest versions of these files in this directory. If the personality file required for the EM board is not in the same directory, the MMDS05 will prompt you for one. You may select one anywhere on the drive on which the MMDS05 software resides.

2.2.1 MC68HC705E6 Emulation Limitations

For more information about the MC68HC705E6, see the corresponding technical data books.

2.2.2 MC68HC05E6 Emulation Limitations

Limitations are as per 2.2.1.

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2.3 REMAINING SYSTEM INSTALLATION

When you have configured headers J1 to J4 and made sure that the resident MCU is appropriate, you are through with E6EM configuration:

- To install the E6EM in an MMDS05 station module, remove the panel from the station-module top. Fit together EM connectors P2 and P3 (on the bottom of the board) and control-board connectors P11 and P12. Snap the corners of the EM onto the plastic standoffs. Connect the target cable, if appropriate. Replace the panel.
- If your E6EM already is installed in the station module, reconnect the target cable (if necessary). Replace the panel.

At this point, you are ready to make remaining cable connections, as necessary, and restore power. For instructions, consult the MMDS05 operations manual (MMDS05OM/D).

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CHAPTER 3
HC05EVS CONFIGURATION AND OPERATION

This chapter explains how to configure your E6EM for use as part of an HC05EVS. For other parts of system installation or configuration, see the HC05EVS operations manual (HC05EVSOM/D). (If you will use your E6EM as part of an MMDS05 system, go to Chapter 2 for configuration information.)

Paragraph 3.1 explains how to set E6EM jumper headers. Paragraph 3.2 explains considerations pertaining to the MCU you emulate. Paragraph 3.3 lists limitations on using the E6EM in an HC05EVS. Paragraph 3.4 explains pin assignments and signal descriptions for the logic analyzer connector (P1). Paragraph 3.5 explains remaining system configuration.

Note that you can configure a E6EM already installed on the HC05EVS platform board. To do so, disconnect platform-board power, then follow the guidance of this chapter.

CAUTION

Be sure to disconnect power if you reconfigure an installed EM. Reconfiguring EM jumper headers with power left on can damage HC05EVS circuits.

3.1 SETTING E6EM JUMPER HEADERS

Your E6EM has four jumper headers, J1 to J4. Sections 3.1 explain how to configure these headers.

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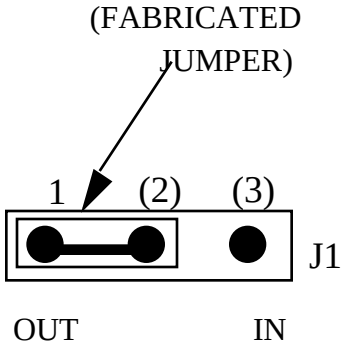
3.1.1 Reset Select Header (J1)

Jumper header J1 controls the path of a target reset. The diagram below shows the factory configuration: the fabricated jumper between pins 1 and 2 enables your E6EVS to reset the target when you press the user or master reset switch.

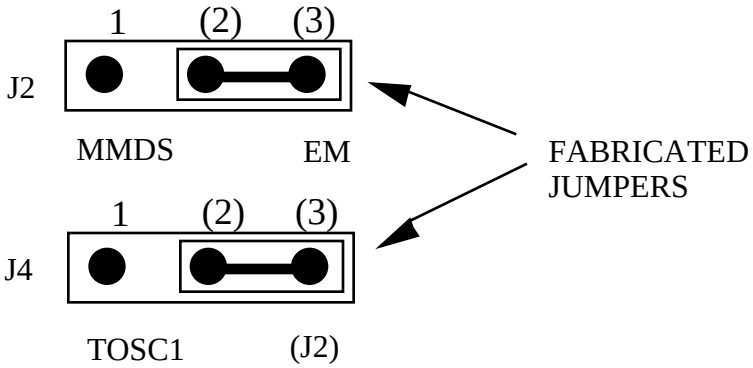


Alternatively, you may enable the target system to reset the E6EVS. To do so:

- Reposition the E6EM J1 jumper between pins 2 and 3, and
- Insert a fabricated jumper into platform-board header J3.

3.1.2 Clock Source Select Headers (J2, J4)

Jumper headers J2 and J4 determines the source of the clock signal. The diagram below shows the factory configuration of these jumpers: the fabricated jumper between pins 2 and 3 selects the E6EM canned oscillator clock source.



Jumper J2 can be used to select between an internal generated clock or a external clock generated by the target system. If the target clock is selected by placing the jumper on J2 between pins 1 and 2 the position of the fabricated jumper on J1 does not matter.

NOTE

The only valid position of the J1 fabricated jumper is between pins 2 and 3 when using the E6EM as part of an EVS system.

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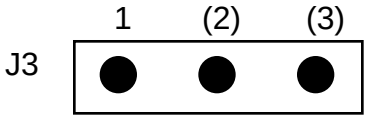
3.1.3 Clock Stretch Select Header(J3)

Jumper header J3 determines the source of clock stretching (if required). By default board is shipped from the factory with no jumper installed ie with the clock stretch function disabled. To enable clock stretch add jumper between pins 1 and 2 for DACIA cycle stretching (affects locations $3FE0 - $3FE3) or between pin 2 and 3 for monitor map cycle stretching.



3.2 THE EMULATED MCU

The factory ships the E6EM with an MC68HC705E6 resident MCU. This MCU is suitable for emulation of both the MC68HC705E6 and the MC68HC05E6.

3.2.2 MC68HC705E6 Emulation

For more information about the MC68HC705E6 features, see the corresponding technical data books.

3.2.3 MC68HC05E6 Emulation

For more information about the MC68HC05E6 features, see the corresponding technical data books.

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3.3 EVS LIMITATIONS

This paragraph explains the limitations that apply to using your E6EM in an HC05EVS. (These limitations apply regardless of the resident MCU.)

Limitation 1. CLI/RTI. You may not trace a clear interrupt mask (CLI) or return from interrupt (RTI) instruction with an interrupt enabled and pending, due to MCU interrupt handling. Attempting such a trace causes an interrupt in the monitor map; this forces a software reset of the HC05EVS. User breakpoints remain in the user map as SWI instructions; you must remove such SWI instructions.

Limitation 2. Branch. Do not trace a conditional branch instruction (such as BRCLR) that branches to itself. As the monitor places an SWI instruction on the object of the branch, the system never would execute the instruction. However, it would appear to you that the instruction had executed. You may enter a G command while the PC points to this type of instruction as long as the instruction is not a breakpoint address.

Limitation 3. IRQ/SWI. Whenever possible, avoid mixing interrupt requests (IRQs) and user software interrupts (SWIs). This prevents a possible IRQ-SWI timing problem: a concurrent hardware interrupt and SWI could cause an HC05EVS failure that could stop program execution. To recover from such a failure (which occurs very infrequently, statistically), press the master reset switch (SW3).

Limitation 4. Memory Map. You must be aware of the memory map of the MCU being simulated; be sure to use only valid ROM locations. The HC05EVS does not provide protection to limit user programs to the exact amount of MCU ROM available. (For information about memory maps, consult the technical data book for the MCU.)

Limitation 5. COP. The computer operating properly (COP) update register serves as an EPROM location for the resident MCU. Accordingly, the platform-board write-protect jumper header must enable write protection. Otherwise, any writes to the COP update register change the value stored in user pseudo ROM.

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3.4 LOGIC ANALYZER CONNECTOR P1

Figure 3-1 shows the pin assignments for logic analyzer connector P1. Table 3-2 lists signal descriptions for this connector.

Note: * indicates an active low signal

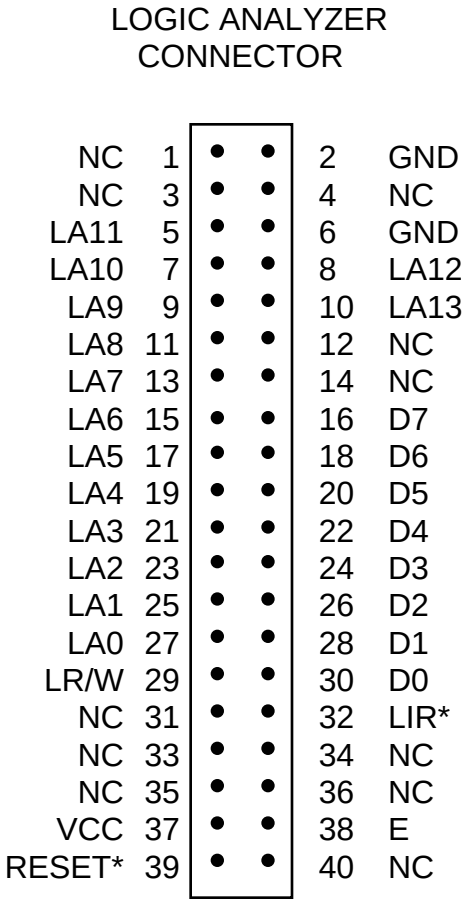

Figure 3-1. Connector P1 Pin Assignments

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Table 3-2. Logic Analyzer Connector P4 Signal Descriptions

PIN	MNEMONIC	SIGNAL
1, 3, 4, , 12, 14, 31, 33 — 36, 40	-----	No connection
2, 6	GND	GROUND
5, 7,9,11,13. 15. 17, 19, 21, 23, 25, 27	LA11 — LA0	LATCHED ADDRESSES (bits 11—0) - MCU latched output address bus.
8,10	LA12,13	LATCHED ADDRESSES (bit 12-13) - MCU latched output address bus.
16, 18, 20, 22, 24, 26, 28, 30	AD7 — AD0	DATA BUS (bits 7—0) - MCU multiplexed I/O data bus.
29	LR/W	LATCHED READ/WRITE - Active-high output signal that indicates the direction of data transferred on the bus.
32	LIR	LOAD INSTRUCTION REGISTER - Open-drain, active-low output signal that indicates an instruction is starting.
37	VCC	+5 VDC POWER - Input voltage (+5 Vdc @ 1.0 A) used by EVS logic circuits.
38	E	EXTERNAL CLOCK - Internally generated output clock signal used as a timing reference. The frequency of E clock is 1/2 the input frequency of the signal on the OSC2 pin.
39	RESET	RESET - Active-low bidirectional signal for starting an EVS reset.

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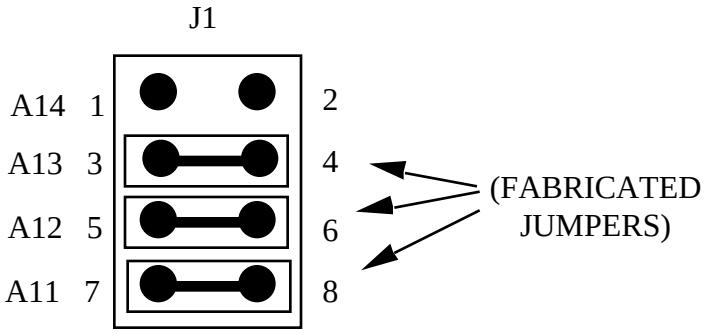
3.5 REMAINING SYSTEM INSTALLATION

When you have configured headers J1to J4 and made sure that the resident MCU is appropriate, you are through with E6EM configuration.

Find jumper header J1 of the HC05EVS platform board. Make sure that three fabricated jumpers are installed, per the diagram below.



To install the E6EM on an HC05EVS platform board, fit together EM connectors P3 and P4 (on the bottom of the board) and platform-board connectors P3 and P4. Snap the corners of the EM onto the plastic stand-offs.

At this point, you are ready to make remaining cable connections, as necessary, and restore power. For instructions, consult the HC05EVS operations manual (HC05EVSOM/D).

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